

AM WE CLAIM:

5 1. An immunogenic conjugate, comprising: the reductive amination product of an immunogenic capsular polymer fragment having at least two carbonyl groups and derived from the capsular polymer of a bacterial pathogen, and a bacteria toxin or toxoid.

2. The immunogenic conjugate of claim 1, wherein the capsular polymer is immunogenic in mature humans and less immunogenic in infant humans.

10 3. The immunogenic conjugate of claim 1, wherein the reductive amination is performed in the presence of cyanoborohydride anions.

4. The immunogenic conjugate of claim 1, wherein the toxin or toxoid is diphtheria toxin or toxoid.

15 5. The immunogenic conjugate of claim 4, wherein the toxoid is CRM<sub>197</sub>.

6. The immunogenic conjugate of claim 1, wherein the toxin or toxoid is tetanus toxin or toxoid.

20 7. The immunogenic conjugate of claim 1, wherein the toxin or toxoid is a pseudomonas toxin or toxoid.

8. The immunogenic conjugate of claim 1, wherein the toxin or toxoid is a staphylococcus toxin or toxoid.

9. The immunogenic conjugate of claim 1, wherein the toxin or toxoid is a streptococcus toxin or toxoid.

25 10. The immunogenic conjugate of claim 1, wherein the toxin or toxoid is pertussis toxin or toxoid.

11. The immunogenic conjugate of claim 1, wherein the toxin or toxoid is an Escherichia coli toxin or toxoid.

30 12. The immunogenic conjugate of claim 1, wherein the bacterial pathogen is Haemophilus influenzae type b.

13. The immunogenic conjugate of claim 1, wherein the bacterial pathogen is Escherichia coli.

14. The immunogenic conjugate of claim 1, wherein the bacterial pathogen is Neisseria meningitidis.

15. The immunogenic conjugate of claim 1, wherein the bacterial pathogen is Neisseria meningitidis serogroup A.

16. The immunogenic conjugate of claim 1, wherein the bacterial pathogen is Neisseria meningitidis serogroup C.

5 17. The immunogenic conjugate of claim 1, wherein the bacterial pathogen is Streptococcus pneumoniae.

18. The immunogenic conjugate of claim 1, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 6.

10 19. The immunogenic conjugate of claim 1, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 12.

20. The immunogenic conjugate of claim 1, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 14.

21. The immunogenic conjugate of claim 1, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 19.

15 22. The immunogenic conjugate of claim 1, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 23.

23. The immunogenic conjugate of claim 1, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 51.

20 24. The immunogenic conjugate of claim 5, wherein the bacterial pathogen is Haemophilis influenzae type b.

25. The immunogenic conjugate of claim 5, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 6.

26. The immunogenic conjugate of claim 5, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 14.

25 27. The immunogenic conjugate of claim 5, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 19.

28. The immunogenic conjugate of claim 5, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 23.

30 29. The immunogenic conjugate of claim 1, wherein the fragment is derived from the capsular polymer by oxidative cleavage.

30. The immunogenic conjugate of claim 1, wherein the fragment is derived from the capsular polymer by periodate.

31. The immunogenic conjugate of claim 1, wherein the fragment is produced from a capsular polymer by first treating said polymer with acid, base or enzyme and then oxidatively cleaving.

32. An immunogenic conjugate comprising the reductive amination product of an immunogenic capsular polymer fragment having a chain length of from about 10 to about 30 monomeric units and at least two carbonyl groups, which fragment is derived from the capsular polymer of a Streptococcus pneumoniae or Haemophilus influenzae bacterium, and a bacterial toxin or toxoid.

33. The immunogenic conjugate of claim 32, wherein the capsular polymer is immunogenic in mature humans and less immunogenic in infant humans.

34. The immunogenic conjugate of claim 32, wherein the reductive amination is performed in the presence of cyanoborohydride anions.

35. The immunogenic conjugate of claim 32, wherein the toxin or toxoid is diphtheria toxin or toxoid.

36. The immunogenic conjugate of claim 32, wherein the toxoid is CRM<sub>197</sub>.

37. The immunogenic conjugate of claim 32, wherein the toxin or toxoid is tetanus toxin or toxoid.

38. The immunogenic conjugate of claim 32, wherein the toxin or toxoid is a pseudomonas toxin or toxoid.

39. The immunogenic conjugate of claim 32, wherein the toxin or toxoid is a staphylococcus toxin or toxoid.

40. The immunogenic conjugate of claim 32, wherein the toxin or toxoid is a streptococcus toxin or toxoid.

41. The immunogenic conjugate of claim 32, wherein the toxin or toxoid is pertussis toxin or toxoid.

42. The immunogenic conjugate of claim 32, wherein the toxin or toxoid is an Escherichia coli toxin or toxoid.

43. The immunogenic conjugate of claim 32, wherein the bacterial pathogen is Haemophilus influenzae type b.

44. The immunogenic conjugate of claim 32, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 3.

45. The immunogenic conjugate of claim 32, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 6.

5 46. The immunogenic conjugate of claim 32, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 12.

47. The immunogenic conjugate of claim 32, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 14.

10 48. The immunogenic conjugate of claim 32, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 19.

49. The immunogenic conjugate of claim 32, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 23.

50. The immunogenic conjugate of claim 32, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 51.

15 51. The immunogenic conjugate of claim 36, wherein the bacterial pathogen is Haemophilis influenzae type b.

52. The immunogenic conjugate of claim 36, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 6.

20 53. The immunogenic conjugate of claim 36, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 14.

54. The immunogenic conjugate of claim 36, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 19.

55. The immunogenic conjugate of claim 36, wherein the bacterial pathogen is Streptococcus pneumoniae serotype 23.

25 56. The immunogenic conjugate of claim 32, wherein the fragment is derived from the capsular polymer by oxidative cleavage.

57. The immunogenic conjugate of claim 32, wherein the fragment is derived from the capsular polymer by periodate.

30 58. The immunogenic conjugate of claim 32, wherein the fragment is produced from a capsular polymer by first treating said polymer with acid, base or enzyme and then oxidatively cleaving.

59. An immunogenic conjugate comprising: a formalin treated reductive amination product of an immunogenic capsular polymer fragment having at least two carbonyl groups and derived from the capsular polymer of a bacterial pathogen, and a bacterial toxin or toxoid.

60. An immunogenic conjugate comprising: a formalin treated reductive amination product of an immunogenic capsular polymer fragment having a chain length of from about 10 to about 30 monomeric units and at least two carbonyl groups, which fragment is derived from the capsular polymer of a Streptococcus pneumonia or Haemophilus influenzae bacterium, and a bacterial toxin or toxoid.

61. The immunogenic conjugate of claim 59 or 60, wherein the bacterial toxoid is diphtheria toxoid.

62. The immunogenic conjugate of claim 59 or 60, wherein the toxoid is CRM<sub>197</sub>.

63. The immunogenic conjugate of claim 59 or 60, wherein the bacterial toxin or toxoid is tetanus toxin or toxoid.

64. A method for preparing an immunogenic conjugate, comprising: forming the reductive amination product of an immunogenic capsular polymer fragment having at least two carbonyl groups and derived from the capsular polymer of a bacterial pathogen, and a bacterial toxin or toxoid, said reductive amination being performed in the presence of cyanoborohydride ions.

65. The method of claim 64, wherein the capsular polymer is immunogenic in mature humans and less immunogenic in infant humans.

66. The method of claim 64, wherein the toxin or toxoid is diphtheria toxin or toxoid.

67. The method of claim 64, wherein the toxin or toxoid is CRM<sub>197</sub>.

68. The method of claim 64, wherein the toxin or toxoid is tetanus toxin or toxoid.

69. The method of claim 64, wherein the toxin or toxoid is pseudomonas toxin or toxoid.

70. The method of claim 64, wherein the toxin or toxoid is staphylococcus toxin or toxoid.

5 71. The method of claim 64, wherein the toxin or toxoid is streptococcus toxin or toxoid.

72. The method of claim 64, wherein the toxin or toxoid is pertussis toxin or toxoid.

10 73. The method of claim 64, wherein the toxin or toxoid is an Escherichia coli toxin or toxoid.

74. The method of claim 64, wherein the pathogen is Haemophilus influenzae type b.

75. The method of claim 64, wherein the pathogen is Escherichia coli.

15 76. The method of claim 64, wherein the pathogen is Neisseria meningitidis.

77. The method of claim 64, wherein the pathogen is Streptococcus pneumoniae.

20 78. The method of claim 64, wherein the pathogen is Pseudomonas.

79. The method of claim 66, wherein the pathogen is Haemophilus influenzae b.

80. The method of claim 66, wherein the pathogen is Streptococcus pneumonia.

25 81. The method of claim 64, wherein the fragment is derived from the capsular polymer by oxidative cleavage.

82. The method of claim 64, wherein the fragment is derived from the capsular polymer by periodate.

30 83. The method of claim 64, wherein the fragment is produced from a capsular polymer by first treating said polymer with acid, base or enzyme and then oxidatively cleaving.

84. The method of claim 64, further comprising treating said reductive amination product with formalin.

85. The method of claim 84, wherein the bacterial toxoid is diphtheria toxoid.

86. The method of claim 84, wherein the toxoid is CRM<sub>197</sub>.

5 87. The method of claim 84, wherein the bacterial toxin or toxoid is tetanus toxin or toxoid.

88. A vaccine that elicits effective levels of anti-capsular polymer antibodies in humans, comprising: the immunogenic conjugate of claim 1 or 31 and a pharmaceutically acceptable carrier.

10 89. A method for actively immunizing humans against a bacterial pathogen having a capsular polymer, comprising: administering an effective amount of the vaccine of claim 88.

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